Emerging technologies in energy:
Environmental and regulatory considerations for Western Canada

Blue hydrogen

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ENVIRONMENT & ENGINEERING

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Recent years have seen the emergence of new technologies in energy, driven largely by the global shift away from conventional fossil-fuel energy sources toward low-carbon sources of energy and new means of harnessing them. These emerging technologies include those for geothermal, lithium, and hydrogen resources, which have been the subject of rapid policy and regulatory developments in Canada. Geothermal, lithium, and hydrogen technologies are expected to continue to advance in the coming years, as they are increasingly adopted and implemented in Canada and globally.

The physical setting and resource development experience in Western Canada present tremendous opportunities for meaningful growth in the development of these energy resources. However, as is to be expected with emerging sectors, there are uncertainties with respect to the environmental risks and regulatory frameworks that apply, which considerations and regimes are largely in a state of flux.

Osler's legal experts in conjunction with environmental specialists at Matrix Solutions Inc. have created a three-part series that discusses the current environmental and regulatory considerations in Alberta, British Columbia and Saskatchewan associated with the development of geothermal, lithium and blue hydrogen resources.

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Introduction

The concept of a hydrogen economy has long been considered as an alternate means of chemical energy transport and storage for decarbonization, yet until recently it has remained a distant promise mired by significant cost and technological hurdles for large scale adoption. This situation is rapidly changing, however, as energy challenges with existing battery applications are aligning with new advancements in fuel cell technology and the use of hydrogen-natural gas blends for combustion in turbines. Increasingly in these scenarios, hydrogen is being considered as a means of converting carbon-free energy into a chemical fuel which may be able to leverage existing natural gas infrastructure and expertise.

Canada is already one of the top ten hydrogen producers in the world and as such has established supply chains supporting various applications such as petrochemicals and the fertilizer industry. Growing these supply chains provides an opportunity to leverage existing infrastructure to meet international demand as many countries look to build out national hydrogen strategies to combat the effects of climate change. Many of these countries are already significant trading partners with Canada, including Japan, China, the U.S. and a host of European nations. In fact, Canada recently acknowledged this tremendous socio-economic potential by rolling out its own National Hydrogen Strategy. Early studies have indicated that by 2050 Canadian hydrogen production could grow by up to seven times relative to today's production figures to meet global demand.[1]

Process description

Hydrogen can be produced from a variety of feedstocks, including electricity and water, biomass and industrial processes. The most common method of hydrogen production today is steam methane reforming (SMR), which involves a thermochemical reaction where natural gas or a refined petroleum product is combined with steam to release the bonded hydrogen. Within this range of options for hydrogen production, significant effort in Canada is being directed to developing low-to-neutral carbon intensity "blue" hydrogen using SMR paired with carbon capture, utilization and storage (CCUS) to prevent the carbon dioxide by-product from being emitted to the atmosphere. This outcome can be achieved with the addition of a carbon capture loop to existing Canadian SMR operations and by leveraging oil and gas expertise and the geological conditions of the prairie provinces. Successful blue hydrogen developments require plentiful sources of

1 Natural Resources Canada, *Hydrogen Strategy for Canada*, https://www.nrcan.gc.ca/climate-change/the-hydrogen-strategy/23080.

natural gas and water for feedstock and access to facilities or reservoirs to store or process the captured carbon dioxide. Blue hydrogen offers cost and scalability advantages as compared to "green" hydrogen (produced using electricity from renewables with water) and has the added benefit of redeploying existing and underemployed oil and gas expertise and leveraging existing pipeline and natural gas infrastructure.

Environmental considerations

In Western Canada, natural gas is plentiful and there are numerous existing distribution networks that can be accessed for feedstock. Depending on the location of the proposed facility, additional or expanded natural gas pipeline infrastructure may be required to provide the required volumes. There are existing frameworks to regulate natural gas pipeline development in each province (and federally) that can be applied as required.

Commercial-scale hydrogen developments also require substantial amounts of fresh water. As the water is used to make steam and is a reagent in the chemical reaction, facilities require the water source to be relatively free from impurities. As a result, water used for SMR is typically sourced from surface water bodies rather than deep aquifers. The water used in hydrogen production is also a consumptive use, meaning no water is returned to the natural source. Sourcing sufficient water to supply commercial-scale hydrogen production will result in competition with water demands for agriculture, municipal and industrial usage in Western Canada. There are also several areas within Western Canada where new water allocation is limited or constrained. Potential environmental concerns regarding water use therefore need to be evaluated and addressed.

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Opportunities for carbon capture and storage have been identified throughout Western Canada. Existing facilities (such as the Boundary Dam coal-fired power plant in Saskatchewan and the Shell Quest project in Alberta) have demonstrated the viability of underground carbon capture. Numerous facilities have also demonstrated that carbon dioxide injection can be used as an enhanced recovery method in existing oilfields (such as those served by the Alberta Carbon Trunk Line). However, more detailed geologic evaluation is required to delineate the carbon storage potential of other areas throughout Western Canada to be able to store the volumes of carbon dioxide that would be generated from a commercial-scale hydrogen development. Additional carbon dioxide transportation infrastructure would also likely need to be developed to connect the hydrogen facility to suitable storage reservoirs, and concerns regarding the long-term potential of subsurface carbon dioxide migration over time and potential associated environmental effects would need to be examined.

During operations, an additional environmental consideration is the safe storage, handling and distribution of the produced hydrogen. Hydrogen gas containment and storage typically requires specialized equipment to reduce the potential for losses and to manage the risk of explosion. These risks are well understood at existing hydrogen storage and handling facilities. Where efforts are made to replace existing natural gas infrastructure with hydrogen infrastructure, upgrades may be needed to accommodate the safe distribution

of hydrogen. This may include further development of underground storage caverns that have been used to store natural gas and natural gas liquids throughout Western Canada and the world. Should caverns be considered for hydrogen storage, environmental concerns would include securing additional source water for cavern washing, facilities to manage brine waste and ongoing monitoring to assess potential for subsurface migration of fluids. In future, storing hydrogen in a solid-state hydride may permit avoidance of the risks associated with hydrogen stored under pressure, but the associated technologies and methods are not yet sufficiently advanced to support large scale hydrogen storage and distribution.

Alternative hydrogen production technologies

While blue hydrogen is the primary focus of governments and developers in Western Canada (and the focus of this article), hydrogen technology companies are exploring two alternate means of producing hydrogen that merit mention: "green" hydrogen production and in-situ combustion.

Green hydrogen development

One alternative to SMR is the production of hydrogen through an electrolysis reaction – using energy to split a water molecule into hydrogen and oxygen. The "green" hydrogen production process uses renewable energy sources (such as wind or solar) to power the electrolysis reaction. These projects are typically most viable in areas with both abundant freshwater resources and high renewable energy potential. One key environmental concern associated with green hydrogen production is the consumptive water use, similar to what is described above for blue hydrogen development. Each green hydrogen project is also likely to entail environmental considerations associated with its form and geographic setting.

Hydrogen development through in-situ combustion

Another alternative hydrogen production method is currently being piloted in Saskatchewan. Oxygen-enriched air is injected into a depleted oil and gas reservoir, resulting in subsurface in-situ combustion. The heat from the combustion causes a pyrolysis reaction that chemically cracks the hydrocarbon within the formation, releasing hydrogen. Specialized membranes are used to separate the hydrogen from other formation fluids and produce it to surface while the remaining reaction by-products are left underground.

The potential environmental liability issues (described in the Geothermal section) related to acquiring and operating legacy oil assets also apply to this type of hydrogen development. Legacy oil and gas infrastructure's material integrity would need to be evaluated to confirm feasibility of operating in hydrogen service. In addition, there is uncertainty associated with the potential environmental effects of in-situ combustion. This recovery technique has been applied in both oil sands and conventional oil and

gas reservoirs. Constant air injection into the formation requires some vapours to be vented or captured at surface to avoid overpressurization. In other applications, this process has occasionally resulted in the generation of undesirable by-products (e.g., water vapour, hydrogen sulphide) that must be managed. Other legacy oil and gas wells can also serve as preferential pathways for gases produced in the combustion reaction; these wells (if identified) would need to be plugged or remediated to avoid unplanned gas venting.

Regulatory considerations

Regulatory regimes in Western Canada do not explicitly address hydrogen developments. While policy statements from the federal and provincial governments signal that dedicated regulatory frameworks may be forthcoming to promote and streamline blue hydrogen development, these types of facilities are presently governed by existing regimes related to oil and gas and water resources.

This section describes the schemes presently applied or likely to be applied to blue hydrogen developments, including the licensing requirements related to facilities, water diversion and CCUS.

Regulatory regimes in Western Canada do not explicitly address hydrogen developments.

Alberta

Licensing

While Alberta legislation does not explicitly address hydrogen development, blue hydrogen development engages the regulatory regimes applicable to chemical facilities, water use and CCUS.

Facilities: Despite the existence of several hydrogen production facilities in Alberta, there is no express regulatory regime for the licensing of those facilities that would provide clarity to blue hydrogen project proponents.

A key consideration is the need for authorization under Alberta's *Environmental Protection and Enhancement Act* (EPEA), which requires approvals and registrations for designated activities.[2] While the SMR process is not explicitly designated as requiring approval or registration, analogous facilities – such as petrochemical manufacturing plants, sweet gas processing plants and chemical manufacturing plants – often do require approvals under the EPEA.[3]

Alberta Environment and Parks (AEP) has issued approvals under the EPEA for the construction, operation and reclamation of existing hydrogen facilities in the province.[4] Within the EPEA's regulatory framework,

2 *Environmental Protection and Enhancement Act*, RSA 2000, c. E-12, s. 60.
3 *Activities Designation Regulation*, AR 276/2003, s. 5(1) and Schedule 1, Division 2, Part 2 (i) and (ix) and Part 8 (v).
4 Examples include Air Products Canada Ltd.'s Scotford Chemical (Hydrogen) Manufacturing Plant (Approved 6 June 2014), Air Products and Chemicals, Inc.'s Edmonton Hydrogen Plant (Approved 31 May 2016).

AEP appears to treat standalone SMR facilities as "chemical manufacturing plants." SMR facilities are also regulated under the EPEA as integrated components of oil refineries (as with the North West Redwater Partnership's Sturgeon Refinery) and bitumen upgraders (in the case of Shell's Scotford Upgrader). While AEP is responsible for administering the EPEA regime in relation to chemical manufacturing plants and oil refineries, the Alberta Energy Regulator (AER) is responsible for bitumen upgraders and gas processing plants. As such, there is uncertainty as to which regulator – the AER or AEP – will regulate SMR facilities in the future as investment in blue hydrogen production in Alberta continues to grow. This issue is further discussed below.

Application for approval under the EPEA requires detailed information, including the activity's proposed location, capacity and size, timing of its construction and operation, and information concerning potential environmental impacts and mitigations.[5] In the course of reviewing an application, the director (or the AER, as the case may be) may also request further information from the applicant and others, and require the proponent to hold meetings to provide information to the public.[6] If an environmental assessment is required, the director cannot issue an approval or registration until the assessment process is complete.[7] The director may issue or refuse an approval or registration, and may impose terms and conditions on approvals, which terms are typically quite prescriptive in nature.[8]

With respect to facility licences, the AER's licensing regime under the *Oil and Gas Conservation Act* (OGCA) could be applied to blue hydrogen facilities (which are arguably "processing plants" that produce a "gas" as defined in the OGCA),[9] though to date such application has been limited to hydrogen production facilities that are integrated with facilities that traditionally fall under the OGCA (such as oil refineries and bitumen upgraders). In addition, the AER-administered *Pipeline Act* likely applies to hydrogen pipelines associated with SMR facilities, as all gas pipelines require a licence and "gas" is defined broadly as including "any substance recovered from natural gas ... for transmission in a gaseous state." Therefore, even if a licence for an SMR facility is not mandated under the OGCA, AER authorization of any associated hydrogen pipeline infrastructure is likely required.

5 See *Approvals and Registrations Procedure Regulation*, AR 113/93, s. 3(1).
6 *Approvals and Registrations Procedure Regulation*, AR 113/93, ss. 5(1) and (2).
7 *Environmental Protection and Enhancement Act*, RSA 2000, c. E-12, s. 63.
8 *Environmental Protection and Enhancement Act*, RSA 2000, c. E-12, ss. 68(1) and (2)
9 *Oil and Gas Conservation Act*, RSA 2000, c.O-6, ss. 1(1)(y) and (pp).

Water diversion: A licence under the *Water Act* is required to divert fresh water for all industrial purposes, including to produce blue hydrogen.[10] Securing sufficient water allocation under licences is a key consideration in hydrogen development. The director (or, where applicable, the AER) must consider approved water management plans when deciding whether to issue a licence and under what, if any, terms and conditions.[11]

There are five water management plans in Alberta, covering distinct river basins and prescribing considerations for water allocations in their respective geographies. Notably, the water management plan for the South Saskatchewan River Basin, which covers most major southern Alberta watercourses (Red Deer and south), restricts new water allocations and has initiated a market for the transfer of licences in its region.[12]

The *Water Act* also expressly enables the director or AER to consider any applicable water conservation objective when assessing a diversion application. Currently, eight water shortage advisories are in place in Alberta, indicating low flows and flows below instream objectives affecting applications for temporary diversion licences.[13] These constraints on available water resources highlight water licensing as a key regulatory consideration in blue hydrogen development in Alberta.

Carbon capture, utilization, storage: Section 57(5) of the *Mines and Minerals Act* (MMA) grants the Crown ownership of the pore space used for CCUS. Part 9 of the MMA contains regulatory requirements applicable to CCUS, in the form of carbon sequestration, in the province. The legislation enables the minister to enter into agreements for evaluation of subsurface reservoirs to determine suitability for carbon sequestration (evaluation permits),[14] and agreements granting rights to inject captured carbon dioxide into subsurface reservoirs to be sequestered (carbon sequestration leases).[15]

Requirements for evaluation permits and carbon sequestration leases are addressed in the *Carbon Sequestration Tenure Regulation* (Carbon Sequestration Regulation),[16] and include annual rents, monitoring, measurement and verification plans.[17] Applications for carbon sequestration leases must include evidence that the chosen location is suitable for sequestration, and provide a closure plan which meets the prescribed requirements.[18] Before drilling or using a well to sequester carbon dioxide, the lessee must also obtain a well licence and approval under the OGCA.[19]

Securing sufficient water allocation under licences is a key consideration in hydrogen development.

10 *Water Act*, RSA 2000, c. W-3, s. 49(1).
11 *Water Act*, RSA 2000, c. W-3, ss. 51(1), (3) and (4).
12 Alberta Environment, *Approved Water Management Plan for the South Saskatchewan River Basin (Alberta)*, https://open.alberta.ca/publications/0778546209 at ss. 2.1 and 2.7.
13 Alberta Government, *Alberta River Basins*, https://rivers.alberta.ca/.
14 *Mines and Minerals Act*, RSA 2000, c. M-17, s. 115.
15 *Mines and Minerals Act*, RSA 2000, c. M-17, s. 116.
16 *Carbon Sequestration Tenure Regulation*, Alta Reg 68/2011.
17 *Carbon Sequestration Regulation*, ss. 3(2), 6, 7 and 9 (2).
18 *Carbon Sequestration Regulation*, ss. 9 (2)(d) and (f).
19 *Mines and Minerals Act*, RSA 2000, s. 116(2).

Environmental assessment

The requirement for provincial environmental assessment of blue hydrogen projects is likely at the discretion of the director under the EPEA in Alberta. Hydrogen facilities are not listed in the *Environmental Assessment (Mandatory and Exempted Activities) Regulation*, as either mandatory or exempted.[20]

The appropriate regulator

As is sometimes the case with new energy technologies that are not contemplated by existing regimes, blue hydrogen regulation will undoubtedly raise jurisdictional questions pertaining to what regulator is responsible for enforcement of regulatory standards, including those pertaining to environmental assessments and approvals. In Alberta, AEP regulates the enforcement of the EPEA as it applies to oil refineries, power plants, alternative energy plants, petrochemical plants and chemical manufacturing plants, while the AER is responsible for gas plants and bitumen upgraders.[21] It would initially appear that hydrogen, as a gas, would be regulated by the AER. However, as discussed above, existing standalone hydrogen facilities have been regulated exclusively by AEP as chemical manufacturing plants. Given the potential use of hydrogen as an alternative fuel and parallels between chemical and SMR facilities, the regulation of blue hydrogen by AEP may continue to be appropriate.

However, similar to the discussion on lithium technologies in the Lithium section, given the fact that hydrogen technologies make use of conventional natural gas resources (specifically, methane) and that the AER has an existing role in relation to CCUS activities, gas processing and gas pipelines, the AER may be better positioned to provide clear and suitable directions to proponents and a "one-window" regulatory framework that leverages the AER's existing areas of expertise. Further clarity through regulatory reform will be required to resolve this issue.

British Columbia

Licensing

Licensing requirements attach to water diversion and to CCUS. While the licensing requirements for SMR facilities are presently unclear, a permit may be required under the *Oil and Gas Activities Act* (OGAA). Hydrogen proponents must also consider whether an environmental assessment is required based on applicable legislative thresholds.

20 *Environmental Assessment (Mandatory and Exempted Activities) Regulation*, Alta Reg 111/1993.

21 Alberta Energy Regulator, *Environmental Protection and Enhancement Act*, "What We Regulate Under the Act," https://www.aer.ca/regulating-development/project-application/application-legislation/environmental-protection-and-enhancement-act.

Facilities: BC's *Hydrogen Study* notes the need for regulation to provide a clear framework for blue and green hydrogen-producing facilities.[22] Under the current framework, blue hydrogen production through SMR could be considered an "oil and gas activity," regulated and subject to permit requirements under the OGAA, particularly where integrated within oil refining facilities.[23] Oil and gas activities under the OGAA include "the production, gathering, processing, storage or disposal of petroleum, natural gas or both."[24] The legislation provides a broad definition of "natural gas" including "all fluid hydrocarbons, before and after processing, that are not defined as petroleum, and includes hydrogen sulphide, carbon dioxide and helium produced from a well."[25] As SMR involves the processing of natural gas to produce hydrogen, it appears to fall under the BC Oil and Gas Commission (BCOGC)'s purview as an oil and gas activity under the OGAA.

A proponent of an oil and gas activity must obtain a permit and must comply with the OGAA and its regulations as well as the terms of the permit.[26] The application process involves notification and consultation requirements in prescribed circumstances,[27] and allows stakeholders to make written submissions regarding the application.[28] Permit application requirements include a description of the activity, plans, application forms and records required by the BCOGC, a written report of consultations and notifications, and may require payment of security.[29] The BCOGC considers the application and any written submissions, as well as the government's environmental objectives,[30] before deciding whether to issue a permit for the oil and gas activity.[31]

Water diversion: As in Alberta, securing sufficient water allocation is a key regulatory consideration for blue hydrogen developments in B.C. The province has its own distinct legislative regime for water licensing and allocation under the *Water Sustainability Act* (WSA). The WSA defines several "purposes" for which water may be diverted, subject to the Act's requirements. Diverting water for use in SMR facilities does not appear to fit neatly within any of the categories established under the WSA. For instance, "oil and gas purpose" is defined as "use of water in the development of petroleum or natural gas wells or the production of petroleum

BC's Hydrogen Study notes the need for regulation to provide a clear framework for blue and green hydrogen-producing facilities.

22 Zen and the Art of Clean Energy Solutions, *British Columbia Hydrogen Study* (June 2019), https://www2.gov.bc.ca/assets/gov/government/ministries-organizations/ministries/zen-bcbn-hydrogen-study-final-v5_noappendices.pdf at PDF 161.

23 For example, Tidewater Midstream and Infrastructure Ltd.'s Prince George Refinery (formerly owned by Husky) produces hydrogen used in its refining process through SMR (see Zen and the Art of Clean Energy Solutions, *British Columbia Hydrogen Study* (June 2019), https://www2.gov.bc.ca/assets/gov/government/ministries-organizations/ministries/zen-bcbn-hydrogen-study-final-v5_noappendices.pdf at PDF 105).

24 *Oil and Gas Activities Act*, SBC 2008, c. 36, s. 1(2).

25 *Oil and Gas Activities Act*, SBC 2008, c. 36, s. 1(1) and *Petroleum and Natural Gas Act*, RSBC 1996, c. 361, s. 1.

26 *Oil and Gas Activities Act*, SBC 2008, c. 36, s. 21.

27 See *Consultation and Notification Regulation*, BC Reg 217/2017

28 *Oil and Gas Activities Act*, SBC 2008, c. 36, s. 22.

29 *Oil and Gas Activities Act*, SBC 2008, c. 36, ss. 24(1) and 30.

30 Prescribed under the *Environmental Protection and Management Regulation*, BC Reg 41/2016.

31 *Oil and Gas Activities Act*, SBC 2008, c. 36, s. 25(1).

or natural gas resources,"[32] whereas "industrial purpose" is limited to very specific industrial uses that are enumerated in regulations, the most relevant being the use of water "for the operation of a sawmill, shipyard, factory or other manufacturing facility or for the operation of a wharf, and includes the use of water in a gravel washing plant or the use in an industrial context of water to prevent a fire."[33] Further clarity on where SMR uses fall within this regime is required.

Regardless, blue hydrogen project proponents will likely require a licence to divert and beneficially use a specified quantity of water under the WSA.[34] The comptroller or water manager may only issue licences to the entities listed under the Act. This list includes "an owner of land or a mine," a category which many proponents will fall into, as the WSA's definition of an "owner" includes a person "entitled to possession of the land." Proponents should note that partnerships, lacking legal personhood, may be precluded from holding a water licence.[35]

In determining whether to grant a licence under the WSA, the comptroller or water manager must consider environmental flow needs, defined as "in relation to a stream ... the volume and timing of water flow required for the proper functioning of the aquatic ecosystem of the stream."[36] Critical environmental flow thresholds take precedence over water allocations. In applying for a licence, applicants must provide any plans, specifications and other information requested by the decision maker,[37] and may be required to have an assessment performed and report prepared by a qualified person specified by the decision maker. Licences may be subject to terms and conditions,[38] and a decision maker may impose mitigation measures where they determine that licensed activities are likely to have significant adverse effects on water quantity.[39] Successfully obtaining a water licence on agreeable terms is an essential regulatory consideration for hydrogen developments in B.C.

Carbon capture, utilization, storage: Pore space in British Columbia is Crown-owned. The *Petroleum and Natural Gas Act* (PNGA) allows the provincial government to designate land for storage, and such land, whether privately or publicly owned, becomes Crown land after 90 days.[40]

32 *Water Sustainability Act*, SBC 2014, c. 15, s. 2.
33 *Water Sustainability Regulation*, B.C. Reg 36/2016, s. 2 and Schedule A.
34 *Water Sustainability Act*, SBC 2014, c. 15, s. 7(1)(a).
35 *Water Sustainability Act*, SBC 2014, c. 15, s. 9(a). See a discussion of leases to Crown land, the definition of "owner" and entitlement to hold water licenses under the predecessor to the WSA in *Harrison Hydro Project Inc. v. Environmental Appeal Board*, 2017 BCSC 320, affirmed 2018 BCCA 44, application for leave dismissed 2018 CanLII 71038 (SCC). See also *Derrickson v. Kennedy*, 2006 BCCA 356 at para 10.
36 *Water Sustainability Act*, SBC 2014, c. 15, ss. 15 and 1.
37 *Water Sustainability Act*, SBC 2014, c. 15, s. 12(1)(b)
38 *Water Sustainability Act*, SBC 2014, c. 15, s. 14.
39 *Water Sustainability Act*, SBC 2014, c. 15, s. 16.
40 *Petroleum and Natural Gas Act*, RSBC 1996, c. 361, ss. 127-129.

B.C.'s PNGA provides a scheme for permitting storage reservoirs and wells which may be used for carbon storage. A licence is required to explore for a storage reservoir, in most circumstances.[41] The Act also allows the minister to lease storage reservoirs upon accepting applications.[42] The *Petroleum and Natural Gas Storage Reservoir Regulation* prescribes an annual rent per hectare for reservoir leases.[43]

In addition, the use of a storage reservoir is an "oil and gas activity,"[44] and is therefore subject to permitting requirements under the OGAA, as described above in relation to blue hydrogen SMR facilities.

Environmental assessment

B.C. environmental assessment processes apply to projects that are described in the regulation, that meet effects thresholds, or that are designated as reviewable by the minister under section 11 of the *Environmental Assessment Act* (BCEAA).

Like Saskatchewan and Alberta's respective regimes, the BCEAA does not explicitly require or exempt hydrogen developments from environmental assessment. However, any blue hydrogen projects that trigger effects thresholds under B.C.'s environmental assessment regime will likely require an environmental assessment. For instance, chemical manufacturing facilities producing 100,000 tonnes or more per year meet the threshold for environmental assessment,[45] as do water diversion projects diverting water at a rate exceeding 10 million cubic metres of water per year or groundwater exceeding a rate of 75 litres per second.[46] Regardless, there remains some risk that SMR facilities and associated components will be subject to provincial environmental assessment requirements by virtue of ad hoc designation powers under the Act.

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Saskatchewan

Licensing

Key licensing considerations in Saskatchewan include water licences and uncertainty regarding the need to license facilities associated with blue hydrogen development. CCUS, which is occurring in Saskatchewan, is permitted pursuant to an established legislative regime.

Facilities: Licensing requirements for SMR facilities are presently unclear under the Saskatchewan regime, and should be addressed explicitly to facilitate blue hydrogen development.

41 *Petroleum and Natural Gas Act*, RSBC 1996, c. 361, s. 126(1).
42 *Petroleum and Natural Gas Act*, RSBC 1996, c. 361, s. 130.
43 *Petroleum and Natural Gas Storage Reservoir Regulation*, BC Reg 269/2010, s. 7.
44 *Oil and Gas Activities Act*, SBC 2008, c. 36, s. 1(2).
45 *Reviewable Projects Regulation, BC Reg 243/2019, s 3(1) and Table 1.*
46 *Reviewable Projects Regulation, BC Reg 243/2019, s 3(1) and Table 9.*

Under the existing framework, blue hydrogen may constitute a "product" as defined in the *The Oil and Gas Conservation Act* (SKOGCA), which includes commodities "made from oil or gas and includes ... by-products derived from oil or gas."[47] Similarly, a blue hydrogen SMR facility may be considered a "facility" under the SKOGCA,[48] in which case a licence, or exemption, must be obtained pursuant to section 8.01. Facility licence eligibility criteria are established in the *Oil and Gas Conservation Regulations* (SKOGCR) and require that the licence holder have an ownership interest in the facility.[49]

The Saskatchewan government has published a directive establishing requirements for facility licences.[50] The Licence Directive lists those facilities that require a licence and those that are exempt. However, the Licence Directive does not address hydrogen facilities, leaving open the question as to whether SMR operations must be licensed as analogous to "Gas Processing Plants," or whether they are exempt from licensing as part of "midstream and downstream facilities and sites."[51] This lack of clarity should be addressed to better enable hydrogen development.

Water diversion: The *Water Security Agency Act* (WSAA) imposes licensing requirements for water allocations and also requires approval for construction and operation of works that divert water.[52] Applicants for a water rights licence and approval to construct and operate works must be owners or have a legal interest in the land the works will be constructed on. Leasing the land is sufficient to meet this requirement.[53] Applicants must provide a description of the proposed works, a legal description of the land, the applicant's interest in the land, and a detailed description of the source, volume and method of diverting water.[54]

The Water Security Agency (Agency) may issue water rights licences for any term and subject to any terms and conditions that the Agency deems appropriate.[55] As with licences, approvals to construct may also be subject to whatever terms and conditions the Agency deems appropriate. The Agency is also obliged to publish notices of applications for diversion works, triggering a public comment process, and, if it is of the view that the proposed works "may impair the environment or have an impact on natural resources," it may

47 *The Oil and Gas Conservation Act*, RSS 1978, c. O-2, s. 2(1)(n).
48 *Oil and Gas Conservation Regulations*, RRS 2012, c. O-2 Reg 6, s. 2(1)(m).
49 *Oil and Gas Conservation Regulations*, RRS 2012, c. O-2 Reg 6, ss. 12 and 2(1)(yy).
50 Saskatchewan, *Directive PNG001: Facility License Requirements*, *Revision 1.1* (June 2020) ["Licence Directive"].
51 License Directive at PDF 5 and 6.
52 *The Water Security Agency Act*, SS 2005, c. W-8.1, ss. 50 and 59-62.
53 See Water Security Agency, *Instructions to Complete Application for Water Rights Licence and Approval to Construct and Operate Works under The Water Security Agency Act* (revised 22 January 2019), https://www.wsask.ca/Permits-and-Approvals/Start-Here/#using%20water at 1.
54 Water Security Agency, *Instructions to Complete Application for Water Rights Licence and Approval to Construct and Operate Works under The Water Security Agency Act* (revised 22 January 2019), https://www.wsask.ca/Permits-and-Approvals/Start-Here/#using%20water at 1-2.
55 *The Water Security Agency Act*, SS 2005, c. W-8.1, s. 50(2).

forward the application to the minister responsible for *The Environmental Management and Protection Act, 2010*.[56] If he or she believes the withdrawals create "an enhanced risk of an adverse effect occurring", the minister can require the proponent to obtain an environmental permit.[57]

In evaluating applications for surface or groundwater allocations (including licences and approvals for diversion works), the Agency considers scarcity of the water supply at the point of diversion, including during drought conditions, purpose of the water use, quality of the source water and impacts to adjacent water users, the watershed and future water management. The Agency will also consider, where necessary, mitigation measures or operating conditions to manage or prevent impacts.[58]

As in other jurisdictions, obtaining sufficient water allocation is an important consideration for hydrogen projects in Saskatchewan.

Carbon storage: In Saskatchewan, the Crown owns all pore spaces that were once occupied by Crown minerals.[59] Ownership of pore spaces on freehold lands in Saskatchewan is not prescribed by legislation and is less clear. Common law suggests that, at least where pore space is not associated with mineral extraction, title belongs to the surface owner.

CCUS falls within the licensing regime established by the SKOGCA. The Act regulates any "waste processing facility," which means "any facility that is constructed and operated for the purpose of containing, storing, handling, treating, processing, recovering, reusing, recycling, destroying or disposing of oil and gas waste."[60] Safe storage of substances injected into subsurface formations is one of the SKOGCA's stated purposes.[61] The SKOGCR exempts caverns for gas storage (not including wells or surface infrastructure) from facility licensing requirements.[62]

Ownership of pore spaces on freehold lands in Saskatchewan is not prescribed by legislation and is less clear.

Environmental assessment

The *Environmental Assessment Act* (SEAA) makes any "development" subject to approval.[63] The SEAA defines "development" as including any project, operation or activity which is likely to "substantially utilize any provincial resource and in so doing pre-empt the use, or potential use, of that resource for any other purpose" or "involve

56 *The Water Security Agency Act*, SS 2005, c. W-8.1, s. 61.
57 *The Environmental Management and Protection Act, 2010*, SS 2010, c. E-10.22, s. 26(1).
58 Saskatchewan Water Security Agency, *Permits and Approvals: Water Allocation*, https://www.wsask.ca/Permits-and-Approvals/Water-Allocation/.
59 *The Crown Minerals Act*, RSS 1984 c-50.2, s. 27.2.
60 *Oil and Gas Conservation Regulations*, RRS 2012, c. O-2 Reg 6, s. 2(1)(vv).
61 *The Oil and Gas Conservation Act*, RSS 1978, c. O-2, s. 3(1)(g).
62 *Oil and Gas Conservation Regulations*, RRS 2012, c. O-2 Reg 6, s. 15(d).
63 *The Environmental Assessment Act*, SS 1979-80, c. E-10.1, s. 15.

a new technology that is concerned with resource utilization and that may induce significant environmental change."[64] The water-intensive nature of blue hydrogen production may trigger the need for an environmental assessment under the SEAA.

Proponents may apply for a determination regarding whether their project is a development subject to environmental assessment requirements in Saskatchewan, as described in the Lithium section.[65]

A path forward

Government policies

While a cohesive regulatory framework for hydrogen production is yet to be established in any of the Western Canadian provinces addressed herein, governments are currently under pressure to incentivize the development of hydrogen production. For instance, the Government of Canada recently announced a memorandum of understanding with Germany that commits both countries to collaborating more closely on clean energy innovation and trade, including an emphasis on hydrogen production as a low carbon fuel.[66] Both the Alberta and federal governments have published hydrogen strategies aimed at increasing hydrogen production through government support.[67] Goals of these strategies include passing legislation and enacting regulations, policy and specific standards to enable and support the development of hydrogen technologies. In B.C., there is no similar hydrogen strategy; however, a recent study commissioned by the B.C. government on hydrogen technology found that hydrogen plays an important role in B.C.'s plan to reduce greenhouse gas emissions.[68]

These policy developments suggest that hydrogen proponents in Western Canada will eventually be supported by regulations that facilitate the development of hydrogen production facilities and associated technologies, as well as the use of hydrogen energy for various purposes. It is likely that, in the near term, we will see more specific regulation and policy applicable to hydrogen production and supporting technology.

64 *The Environmental Assessment Act*, SS 1979-80, c. E-10.1, s. 2(e).
65 See *The Environmental Assessment Act*, SS 1979-80, c. E-10.1, s. 7.2.
66 Government of Canada, *Canada Strengthens Energy Partnership with Germany* (March 16, 2021), https://www.canada.ca/en/natural-resources-canada/news/2021/03/canada-strengthens-energy-partnership-with-germany.html
67 Government of Alberta, Natural Gas Vision and Strategy, https://www.alberta.ca/natural-gas-vision-and-strategy.aspx; Natural Resources Canada, *Hydrogen Strategy for Canada*, https://www.nrcan.gc.ca/climate-change/the-hydrogen-strategy/23080; see also Paula Olexiuk et al, December 2020, *Federal Government Announces Canada's Hydrogen Strategy*, https://www.osler.com/en/resources/regulations/2020/federal-government-announces-canada-s-hydrogen-strategy.
68 Zen and the Art of Clean Energy Solutions, *British Columbia Hydrogen Study* (June 2019), https://www2.gov.bc.ca/assets/gov/government/ministries-organizations/ministries/zen-bcbn-hydrogen-study-final-v5_noappendices.pdf at PDF 26.

Incentivizing hydrogen development

Clean fuel standards may incentivize oil and gas producers to invest in hydrogen production. Currently, fuel producers can receive credits for producing less carbon intensive fuels. The clean fuel standards are designed for more traditional conceptions of alternate fuel, such as diesels and ethanol, as they provide credits to fuel producers for including more environmentally friendly blends in gasoline fuel production. A possible way to utilize this existing framework is to expand the availability of renewable fuel credits to oil and gas producers who leverage their resources to make hydrogen.

For example, in Alberta, the *Petrochemicals Diversification Program Royalty Credit Regulation* allows for producers to receive royalty credits for methane, ethane or propane production.[69] The royalty credits can then be used to offset the royalty payments that are owing to the Crown.[70] While this regime is specifically for methane, ethane and propane, there is a close relationship between the goals of the program, the products it covers and hydrogen production such that extending the regulation to cover hydrogen production would be logical and further promote diversification of the energy market.

Hydrogen projects located in Alberta are also eligible for capital grants under Alberta's Petrochemical Incentive Program, provided they meet minimum investment and job-creation requirements.[71] This program provides a significant capital grant once the facility is operating.

In B.C., hydrogen is a renewable fuel pursuant to the *Greenhouse Gas Reduction (Renewable and Low Carbon Fuel Requirements) Act* (GGRA).[72] This definition is likely to have positive implications for incentivizing hydrogen manufacturers in B.C.

The Saskatchewan Petroleum Innovation Incentive (SPII) offers transferable royalty credits for eligible innovative projects at a rate of 25% of the project's costs. Notably, qualifying innovations must be the first of their kind in Saskatchewan.[73] Blue hydrogen developments in Saskatchewan may also be eligible for transferable royalty tax credits at 15% of project costs through the Oil and Gas Processing Investment Incentive (OGPII). The OGPII may be available for existing facility expansions as well as for new facilities.[74]

69 *Petrochemicals Diversification Program Royalty Credit Regulation*, Alta Reg 54/2016, s. 2.
70 *Petrochemicals Diversification Program Royalty Credit Regulation*, Alta Reg 54/2016, s. 6.
71 Alberta Energy, *The Alberta Petrochemicals Incentive Program: Program Guideline Document,* https://open.alberta.ca/dataset/ba855f49-bb70-470a-8d9e-6c850eec5c5a/resource/a765a45f-acbc-4952-bc9e-b276eafd2190/download/energy-alberta-petrochemicals-incentive-program-program-guideline-document-2020.pdf at 5 -6.
72 *Greenhouse Gas Reduction (Renewable and Low Carbon Fuel Requirements) Act*, SBC 2008, c. 16, s.1.
73 Saskatchewan, *Saskatchewan Petroleum Innovation Incentive (SPII),* https://www.saskatchewan.ca/business/agriculture-natural-resources-and-industry/oil-and-gas/oil-and-gas-incentives-crown-royalties-and-taxes/saskatchewan-petroleum-innovation-incentive#eligibility.
74 Saskatchewan, *Oil and Gas Investment Incentive,* https://www.saskatchewan.ca/business/agriculture-natural-resources-and-industry/oil-and-gas/oil-and-gas-incentives-crown-royalties-and-taxes/oil-and-gas-processing-investment-incentive#benefits.

Proponents may also leverage existing carbon offset frameworks to receive carbon offset credits for the development of blue hydrogen technologies. Both B.C. and Alberta have regulations that provide for proponents to receive credits for the amount in which their projects offset and reduce greenhouse gas emissions.

In B.C., the *Greenhouse Gas Emission Control Regulation*,[75] sets out the requirements each proponent is to meet. Most notably, proponents are to submit a project plan to a validation body (as defined by the regulation) that states how the project will reduce greenhouse gas emissions. Furthermore, pursuant to the GGRA, hydrogen manufactured for use in place of petroleum diesel is considered a renewable fuel and therefore fits neatly into the carbon offset framework.[76]

In Alberta, emission offset projects must meet requirements established under the *Technology Innovation and Emissions Reduction Regulation*[77] (TIER), as well the Standard for Greenhouse Gas Emission Offset Project Developers, created under the TIER, and an approved quantification protocol. While Alberta has an approved quantification protocol in place for CCUS, there is no protocol for hydrogen development or the SMR process. Considerations of how the SMR and CCUS activities are linked may play into how offsets are calculated for blue hydrogen projects, and further clarity regarding how SMR facilities may fit in the TIER framework is required. As in B.C., the Alberta regime requires developers to submit project plans which describe how the project meets offset requirements.[78]

Both B.C. and Alberta have regulations that provide for proponents to receive credits for the amount in which their projects offset and reduce greenhouse gas emissions.

75 *Greenhouse Gas Emission Control Regulation*, BC Reg 250/2015.
76 *Greenhouse Gas Reduction (Renewable and Low Carbon Fuel Requirements) Act*, SBC 2008, c. 16, s.1.
77 *Technology Innovation and Emissions Reduction Regulation*, Alta Reg 133/2019
78 Paula Olexiuk et al., *The More Things Change the More they Stay the Same: Alberta Revamps Carbon Pricing Regime for Large Emitters*, 26 November 2019, available at: https://www.osler.com/en/resources/regulations/2019/the-more-things-change-the-more-they-stay-the-same-alberta-revamps-carbon-pricing-regime-for-large.

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